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FILL QUALITY GUIDELINES FOR LAKEFILLING IN ONTARIO

APPLICATION OF SEDIMENT AND WATER QUALITY GUIDELINES TO LAKEFILLING

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FILL QUALITY GUIDELINES FOR LAKEFILLING IN ONTARIO

APPLICATION OF SEDIMENT AND WATER QUALITY GUIDELINES TO LAKEFILLING

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EXECUTIVE SUMMARY

Introduction

The purpose

The purpose of Ontario's new Fill Quality Guidelines is to protect the quality of the water in the province's lakes and rivers and to prevent pollution from occurring in the future. The guidelines regulate the quality of the fill which may be used in projects ranging from lakefilling as part of urban water front renewal to the construction of a cottage dock. The Fill Quality Guidelines, together with the Provincial Sediment Quality Guidelines will enhance protection of the aquatic environment.

Lakefilling

Lakefilling is the practice of creating new land by placing rubble, stones, concrete, bricks and loose earth into shallow areas in lakes and rivers.

The most obvious example of lakefilling is the Metropolitan Toronto harbour area. Most of the land on which the present Harbourfront development now stands, for instance, was created by lakefilling projects before 1930. The Stelco Pier in Nanticoke on Lake Erie is another example. The 1,191 metres (3,906 feet) dock and causeway is used for unloading and loading raw materials and finished goods transported by Great Lakes ships.

Some of the benefits of lakefilling projects include the creation of land for parks, marinas and wildlife preserves as well as protection of shorelines from erosion or floods.

Monitoring of some existing sites suggests that the fill used has degraded the quality of the water and sediment and has harmed sediment-dwelling organisms, such as worms and midges, which fish eat.

Existing Regulations

Today, most major lakefilling projects proposed by ministries, municipalities or conservation authorities become subject to the Environmental Assessment Act because they are part of a larger project, such as a waterfront park, which is subject to the act.

Private lakefilling proposals may also be designated under the Environmental Assessment Act, if the minister believes that the lakefilling part of a project or the whole project - a marina and waterfront recreation centre, for example - is significant.

All lakefilling projects must meet the requirements of the province's Lake and Rivers Improvement Act administered by the Ministry of Natural Resources (MNR) and the federal Fisheries Act which MNR administers on behalf of Fisheries and Oceans Canada.

Until now, the fill which was placed directly into the water had to meet the requirements of Ontario's Open Water Disposal Guidelines for sediment. These guidelines were developed to determine whether or not dredged material was suitable for disposal in open water, but have been used recently to evaluate potential fill. The new Fill Quality Guidelines for Unconfined Fill replace the Open Water Disposal Guidelines.

Today, if a project is approved under the Environmental Assessment Act and conforms to the Lakes and Rivers Improvement Act and the federal Fisheries Act, then the material to be used as fill must meet the requirements of the Fill Quality Guidelines.

The Fill Quality Guidelines

Only material rated as inert fill according to the guidelines accompanying the forthcoming Materials Management Policy may be used as fill for lakefilling projects. The fill which may be used for lakefilling projects will be divided into two categories - Confined Fill and Unconfined Fill:

- Confined fill may be used for lakefilling projects provided it is placed within the confines of a structure, such as a dyke, which is capable of withstanding the waves of a-once-in-50-years storm. The idea is to prevent the fill from coming into contact with the open water and, in the event of a storm or high waves, being washed away.

- Unconfined fill which may be placed directly into the water must first pass a set of stringent tests including:

  - bulk chemical tests for 11 metals and organic compounds including polychlorinated biphenyls (PCBs), arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, total organic carbon and total phosphorus.

  - the Receiving Water Simulation Test which determines whether or not organic compounds such as PCBs leach out from the fill. The material is checked by putting it into a container of water and shaking it. The water is then tested and must meet the Provincial Water Quality Objectives which protect fish and other aquatic life.

  - further tests which the ministry may order on a case by case basis. The tests may include chemical analyses for nutrients, other metals and organic compounds in the new Provincial Sediment Quality Guidelines.

  Unconfined Fill must meet the Lowest Effect level of the sediment guidelines for organic parameters and either the Lowest Effect Level or what is called the background level of the sediment for metals. The background level is the quality of the sediment before it was affected by industrialization. The Lowest Effect Level is the level of contamination in the sediment at which testing shows there is no toxic effect on the majority of sediment-dwelling organisms. Such sediment is clean to marginally polluted.

  In addition, the fill must not affect the quality of the sediment or kill sediment-dwelling organisms and fish. The fill must be free of substances which could accumulate in organisms or which could form objectionable deposits - such as scum - or ruin the potential of the water for recreation or as a habitat for aquatic life, such a fish, worms and midges.

Fill that fails the tests for Unconfined Fill may qualify as Confined Fill if it meets the requirements for Confined Fill. Material that fails the requirements for Confined Fill must be managed as a waste as described in Regulation 309 under the Environmental Protection Act and/or the procedures described in the proposed Materials Management Policy.

While the lakefilling project is being built all reasonable measures must be taken to keep the water as clear as possible and to reduce the loss of fill. Fill is lost when waves wash it into the lake or river or when the fill does not sink when placed into the water but becomes suspended turning it brown and gritty. Some precautions may include dumping fill only when the water is calm and protecting all exposed areas of the lakefill project from severe storms by dykes and enclosures to prevent erosion.

Guideline Benefits

The guidelines will help environmental managers, who include conservation authority officers and Ministry of the Environment and harbour commission employees, determine what material may be used in lakefill projects.

The guidelines will also complement existing ministry programs for protecting water quality. They include:

- The Municipal Industrial Strategy for Abatement (MISA) - The aim of the program is to reduce and, in some cases, to eliminate discharges of toxic chemicals from industry and municipalities;
- The Remedial Action Plan (RAP) program - The aim of the program is to help clean up the 17 Areas of Concern in the Great Lakes in Ontario which the International Joint Commission identified as being badly contaminated;
- Operations Lifeline, a program to upgrade sewage works, and the Beaches Improvement Program - The aim of these programs is to help improve storm water management.

For copies of the Fill Quality Guidelines for Lakefilling in Ontario, please contact the Public Information Centre of the Ministry of the Environment, 135 St. Clair Ave. W., Toronto, Ontario. M4V 1P5. (416) 323-4321.

FOREWORD

The guidelines provided in this document were developed for evaluating the suitability of fill material for lakefilling. They are designed to protect the aquatic environment from both the physical effects of, and contaminants associated with lakefill materials. The guidelines incorporate features of the Provincial Sediment Guidelines to ensure protection of sediments and the Provincial Water Quality Objectives to ensure protection of water quality and water uses. Some provisions in this document relating to the suitability of fill material for lakefilling, specifically the use of the Confined Fill Guidelines, contain references to material in the Policy for the Management of Excess Soils, Rock, and Like Materials (in preparation).

In addition to the protection of water and sediment quality, many other issues such as habitat alteration, alteration of current patterns, and siting and design, must be addressed before a lakefill can be built. These other issues will be addressed in a Provincial Lakefill Policy currently under development.

Ministry requirements in these Guidelines will not exempt projects from current evaluation procedures under other legislation administered by this Ministry, or by other Ministries or agencies. Proponents are responsible for complying with all appropriate policy and regulations in this regard.

1. INTRODUCTION

Lakefilling refers to the placement of solid material (e.g., loose earth, rubble, broken concrete) in or abutting a waterbody (lakes and rivers) to create structures for flood and erosion control (e.g., shoreline protection or stabilization works), land creation (e.g., waterfront parks and recreational boating facilities) and confined disposal facilities for dredged material.

1.1 Lakefilling in Ontario - Background

Most of the large lakefills for the purpose of land creation have been centred in the western basin of Lake Ontario, especially the area adjacent to the Metro Toronto waterfront. The Toronto Harbour Commission, under Federal charter, has been using this technique to develop the Toronto waterfront since 1911. Over the past 25 years, the Commission has been involved in the construction of the Eastern Headland (also known as the Leslie Street Spit) which is the largest lakefill structure in Lake Ontario.

During the late 1960's and 1970's, the conservation authorities bordering western Lake Ontario and other government agencies (e.g., municipalities, Government of Ontario) proposed shoreline plans which included varying degrees of land creation through lakefilling.

Creation of new land resources through filling in the littoral (shallow, near-shore) zone can be an appealing concept for several reasons. With lakefront property commanding a premium price, the creation of new land by lakefilling is attractive, particularly in the heavily populated western basin of Lake Ontario. In many cases, lakefills provide recreational opportunities that would otherwise not exist and could not be provided through the purchase of existing shoreline properties. In addition, the filling activity provides construction interests with an inexpensive means of disposing of large quantities of waste excavation material and rubble.

Concerns over the environmental implications of lakefilling that have been consistently raised over many years have recently heightened across Ontario, particularly in the Metro Toronto area.

The impact on the aquatic environment of building lakefills using the present methodology has not been adequately assessed. However, monitoring of existing sites has, in some cases, indicated degraded soil, water and sediment quality, and disruption of aquatic communities in the vicinity of lakefill structures.

A main area of concern has centred around the quality of the material that has been used in lakefills. Monitoring of fill quality has indicated that material with the potential to impair water and sediment quality has entered lakefills.

1.2 A Fill Quality Program

The Guidelines which follow have been developed to provide environmental protection from the loss of fill and associated contaminants during lakefilling. They are meant to ensure that lakefilling does not significantly impair water quality, aquatic habitat, and adjacent uses from the loss of fill.

Criteria to address aquatic environmental concerns have been developed such that the quality of fill and method of placement will ensure compliance with:

- The MOE water quality management goal: "To ensure that the surface waters of the province are of a quality which is satisfactory for aquatic life and recreation" (MOE, 1984)
- The Provincial Sediment Quality Guidelines: to protect organisms that are directly impacted by contaminated sediment, namely the sediment-dwelling (benthic) species; and to protect against biomagnification of contaminants through the food chain from sediment contaminant sources.

In addition to the protection of water and sediment quality, many other issues must be addressed before a lakefill can be built. These guidelines do not address these other issues.

2. ENVIRONMENTAL CRITERIA

2.1 General

During construction of a lakefill, major aquatic effects are associated with loss of fill material along with the contaminants associated with the fill. These effects may be chemical or physical.

Chemical effects are associated with changes to water and sediment quality. Physical effects are two-fold: the effects of suspended sediment on water quality, specifically, on turbidity; and, the effects of deposited sediment on aquatic habitat.

Environmental criteria outlined here are designed to determine the acceptability of fill and on-site placement of lakefill materials. These criteria identify two categories of acceptable fill: Confined and Unconfined Fill. The screening system is outlined in Figures 1 to 3.

- Confined fill: material that meets the initial screening criteria only.
- Unconfined fill: material that meets the initial screening criteria as well as additional more restrictive criteria.

If lakefilling material meets the criteria for Confined Fill, the proponent at this point has a choice of following the conditions for placement of Confined Fill, or proceeding to determine if the material meets the criteria for acceptability as Unconfined Fill.

2.2 Chemical Effects

2.2.1 Confined Fill Material Criteria

Confined Fill criteria are based on the protection of the terrestrial environment. The Materials Management Policy Committee is preparing these criteria which are scheduled for completion at the end of 1992. At that time, material for use as Confined Fill must meet the inert fill guidelines outlined in the proposed Policy for Management of Excess Soils, Sediments and Like Materials. In the interim, fill material for use as Confined Fill must meet the Confined Fill Guidelines (Interim) as listed in Appendix B.

Initial acceptability of the lakefill material is determined on the basis of:

- The material meets the Confined Fill Guidelines (Interim) in Appendix B. Sampling and analytical protocols to be followed are described in the document *Sampling and Analytical Protocols* developed as part of the Proposed Policy for Management of Excess Soil, Rock and Like Materials

Material not meeting these criteria will be considered unacceptable for lakefills. Fill material that passes these criteria qualifies as Confined Fill and can be used for lakefilling if the following conditions are met:

- Confined fill is placed within a confining structure such that there will be no loss of material to the surrounding aquatic environment.
- The confining structure is designed to withstand the most significant wave that could occur in storms over a 25-year period. The placement of confined fill can occur only after such a confining structure is completed.
- The confining structure is protected to the estimated 50-year storm significant wave prior to the end of the calm period* during which confined fill was first deposited.

2.2.2 Unconfined Fill Material Criteria

In order to qualify as Unconfined Fill, material passing the criteria referred to above must not impair sediment quality (Persaud *et al.* 1992) and must also meet the following criteria (OMOE 1984):

- The material must be free of substances that could form objectionable deposits (e.g., scums, oil, floating debris, etc.) or impart colour, odour or taste to water.
- The material must be free of substances that could cause "rapid lethality" to aquatic life.
- The material must be free of substances that could result in significant bioaccumulation in aquatic organisms.
- The material must not create water quality conditions that would impair the health and well-being of aquatic life and other normal water uses.

The following tests must be carried out to determine acceptability of fill material according to the above criteria. A mandatory list of parameters requiring analysis is given in Table 1. Other parameters from the Provincial Sediment Quality Guideline list (Tables 1 and 2 of Appendix A) may be required on a case-by-case basis after review of the history of the site where the material originated.

Table 1: Mandatory Parameter List for Unconfined Fill

PCBs
Arsenic
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Zinc
Total Organic Carbon
Total Phosphorus

In order to qualify as Unconfined Fill, the material must first meet the Site-Specific Suitability chemical criteria discussed below and outlined in Figures 2 and 3. Candidate material will be tested by bulk chemical analysis and results reported on a dry weight basis (OMOE (1983) or approved equivalent analytical procedures).

In addition, the material must also meet a visual screening test (Objectionable Substances) and a Receiving Water Simulation test in order to qualify as Unconfined Fill.

Material that meets these criteria qualifies as Unconfined Fill and is suitable for use in direct contact with open water.

Site-Specific Suitability of Fill

Organic Compounds

If sediment quality in the vicinity of the lakefill (i.e., ambient sediment quality) is equal to or better than the No Effect Level of the Provincial Sediment

---

* Calm period is normally considered to be the period from June through August when the normal climatic conditions do not generate any sustained high energy waves. This period may be extended on a case-specific basis if it can be demonstrated, based on climatic records (i.e., wind and wave data) (OMNR 1988), that the occurrence of significant waves greater than 0.5 m will occur with an expected probability of <25%.

Table 2: Background Levels for the Metals

Metal	Background (μg/g dry wt.)
Arsenic	4.2
Cadmium	1.1
Chromium	31
Copper	25
Iron (%)	3.12
Lead	23
Manganese	400
Mercury	0.10
Nickel	31
Zinc	65

Values are based on analyses of Great Lakes pre-colonial sediment horizon.

(February 1992)

Quality Guidelines (Appendix A) then the fill material quality must not exceed the No Effect Level (Figure 2).

If sediment quality (ambient) exceeds the No Effect Level but meets the Lowest Effect Level of the Provincial Sediment Quality Guidelines (Appendix A) then fill material quality must not exceed the Lowest Effect Level.

If fill material quality exceeds the Lowest Effect Level, the fill does not qualify as Unconfined Fill.

Other Parameters

If ambient sediment quality in the vicinity of the lakefill is equal to or better than the Lowest Effect Level then the fill material quality must not exceed the Lowest Effect Level (Figure 3).

If ambient sediment quality exceeds the Lowest Effect Level then fill material quality must be equal to or better than ambient, provided that the quality of the fill material does not exceed the pre-colonial background as defined in Table 2.

Objectionable Substances

The fill material will be thoroughly screened (visually) to ensure it is free of substances such as vegetation, wood, paper, plastic products, metal scraps, odoriferous and colour-imparting materials.

Receiving Water Simulation

Tests for bioaccumulation, and water quality impairment will be carried out by using a test which simulates the water column at the fill face, as described below.

The water column at the fill face will be simulated by placing one part of fill material to twenty parts of distilled water on a weight-to-weight basis and agitating the mixture for 24 hours. After a settling period of one hour, aliquots of the supernatant will be decanted and used in the following test:

> The supernatant will be analyzed for the presence of bioaccumulative organic compounds in the mandatory list (Table 1) and others as may be required on a case specific basis where parameters in Appendix A (Table 2) exceed the No Effect Level guideline in a bulk chemical analysis. The concentration of these substances in the supernatant must be below the Provincial Water Quality Objectives/Guidelines (PWQO/G).
>
> The supernatant will also be analyzed for the other parameters (Table 1) that are known to be present in the material based on bulk chemical analysis. The concentrations of the substances (with the exception of mercury) will not exceed ten times the PWQOs/Gs (this assumes a 10:1 dilution in the near field of the dumping operation; if the dilution is less than 10:1, the appropriate factor applies). Concentrations of mercury will not exceed the PWQO in the supernatant because of its high bioaccumulative potential.

Only when all of the above criteria have been met is the material acceptable as Unconfined Fill.

2.2.3 Rationale - Chemical Effects

When contaminants in fill are lost to the aquatic environment they will either become dissolved in water or remain associated with particulate matter which will eventually settle to the bottom. Contaminants associated with material in a lakefill may also migrate with groundwater and reach the lake.

Contaminants in the water column, either in solution or associated with suspended particulate matter, can have a wide range of effects. These include exceedances of drinking water objectives (with potential human health implications), direct toxicological effects on aquatic biota, bioaccumulation of contaminants through the food chain with possible toxicological effects on predators, and restrictions on commercial management of fish or on sport fish consumption.

Most studies related to lakefilling have concluded that water quality effects are localized, with infrequent detection of nutrients, metals and organics above PWQOs. Neither acute nor chronic biological effects have been documented and, in any case, detecting such effects in the field would be a difficult task.

A PWQO is designed to protect the most sensitive water use whether it be for the protection of aquatic biota, recreation or other uses, and as such it can be used as the "no effect" level. In the vicinity of lakefills, the PWQOs/PWQGs are not routinely violated but are occasionally exceeded. Since acute biological effects in these areas have not been observed, it can be assumed that lakefilling has not had acute toxicological effects on pelagic biota (biota ranging throughout the water column). However, chronic effects may have occurred in localized areas near active filling where PWQOs or PWQGs have been exceeded. Contaminants in fill can also enter the groundwater and migrate to a lake or river. The rate of migration of contaminants in groundwater is expected to be slow, but some migration is nevertheless expected. This aspect will be addressed in the Policy for the Management of Excess Soil and Soil-like Material.

Fill lost to the aquatic environment from a lakefill site is eventually deposited on the bottom. Most will be deposited in the vicinity of the lakefill, at least on a temporary basis. Studies have found elevated levels of some contaminants in biota and sediment in the vicinity of lakefilling operations on the Toronto waterfront; however, it is often difficult to separate the effects of lakefilling from other point and non-point sources of contaminants.

There is little information on uptake of contaminants by biota in the vicinity of lakefills under construction. It can be reasonably assumed that, if the sediments lost during the filling process are contaminated, and there are no other significant sources of contaminants, then aquatic biota in areas adjacent to lakefilling will have higher contaminant body burdens than in areas not influenced by lost fill. Therefore, it is prudent to minimize the loss of fill, and to ensure that any fill lost is not contaminated.

2.3 Physical Effects

2.3.1 Turbidity Criteria

All reasonable measures will be taken during filling operations to minimize turbidity levels. Specific mitigative measures will be determined on a site-specific basis in consultation with Ministry staff, but will include the following general measures:

- Filling in areas exposed to wave action will occur only during a defined "calm" period. During other periods, filling will occur only in protected areas, not prone to wave attack.
- The exposed fill face will be restricted to a specific length, usually 15 metres. All other areas must be protected with erosion-resistant material to withstand, as a minimum, the annual storm event.
- All areas exposed to wave attack must be protected, prior to the end of the calm period, against the estimated 25-year storm significant wave - if confined fill has been used, then the Confined Fill criteria will apply.

Where sensitive water uses are identified, turbidity levels must be within the specifications of the PWQO/PWQG. Site monitoring may be required to ensure compliance with PWQOs/PWQGs. If violations occur, then the proponent will take corrective action immediately, according to the project's contingency plan, in which the proponent identifies essential controls and/or mitigative measures to be taken if violations occur. Such measures may include installations of silt curtains or filling only behind dikes constructed of erosion-resistant material.

2.3.2 Rationale - Turbidity

In extreme cases, turbidity has adverse effects on biota. The short-term levels of suspended sediment (which is one component of turbidity) required to adversely affect biota are higher than levels resulting from lakefilling. Localized levels of suspended solids above 25 mg/L (which is the generally accepted "no effect" level) may occur close to the active fill face; however, such levels are not expected beyond the immediate vicinity of the fill face.

At low levels, turbidity affects water uses such as bathing, industrial water uses and aesthetics. There are specific PWQOs/PWQGs to protect against adverse effects on these uses.

Studies indicate that turbidity increases due to lakefilling activities are usually difficult to discern over natural background levels, although violations of the PWQO/PWQG have been documented. These studies have been carried out in Lake Ontario in the Toronto area where background turbidity levels can be high, obscuring increases from lakefilling. In areas where background turbidity levels are low, violations of the PWQO/PWQG would be expected close to active lakefilling if loose soil is being dumped directly into the water.

2.3.3 Sedimentation Criteria

To minimize sediment losses, the mitigative measures outlined above to reduce turbidity will be required.

All sensitive water uses within the area where sedimentation is likely to occur will be protected. (The proponent will identify control measures prior to undertaking the project as well as remedial measures that will be taken if impacts do occur.)

2.3.4 Rationale - Sedimentation

Fill lost during the lakefilling process is likely to be deposited either along adjacent shorelines or offshore, and could affect navigation routes, water intakes and discharges, and aquatic habitat.

Deposition of fine-grained sediments and associated changes in benthic (bottom-dwelling biota) community structure have been documented in the vicinity of lakefills as a direct result of the loss of fill. In extreme cases, close to active filling, benthic communities are absent. Except in protected areas such as embayments and in small water bodies, deposited material will eventually be transported to deep parts of the lake.

3 REFERENCES

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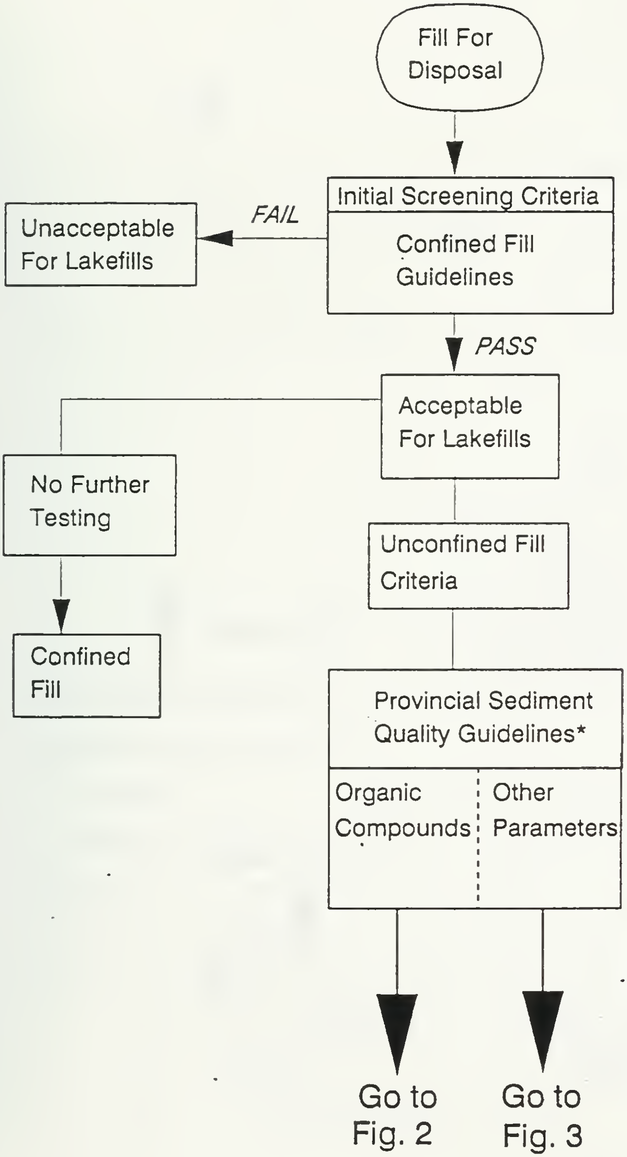
ONTARIO MINISTRY OF NATURAL RESOURCES, 1988. Wave Climate Database Catalogue, Conservation Authorities and Water Management Branch, Toronto, Ontario.

PERSAUD, D., R. JAAGUMAGI and A. HAYTON. 1992. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Toronto. 30pp.

Figure 1. Categorization Of Fill For Lakefilling



*** NOTE:**

Both Organic Contaminants And Other Parameters Must Pass Unconfined Fill Criteria For Material To Be Acceptable As Unconfined Fill

Figure 2. Site Specific Sediment Criteria For Organic Compounds

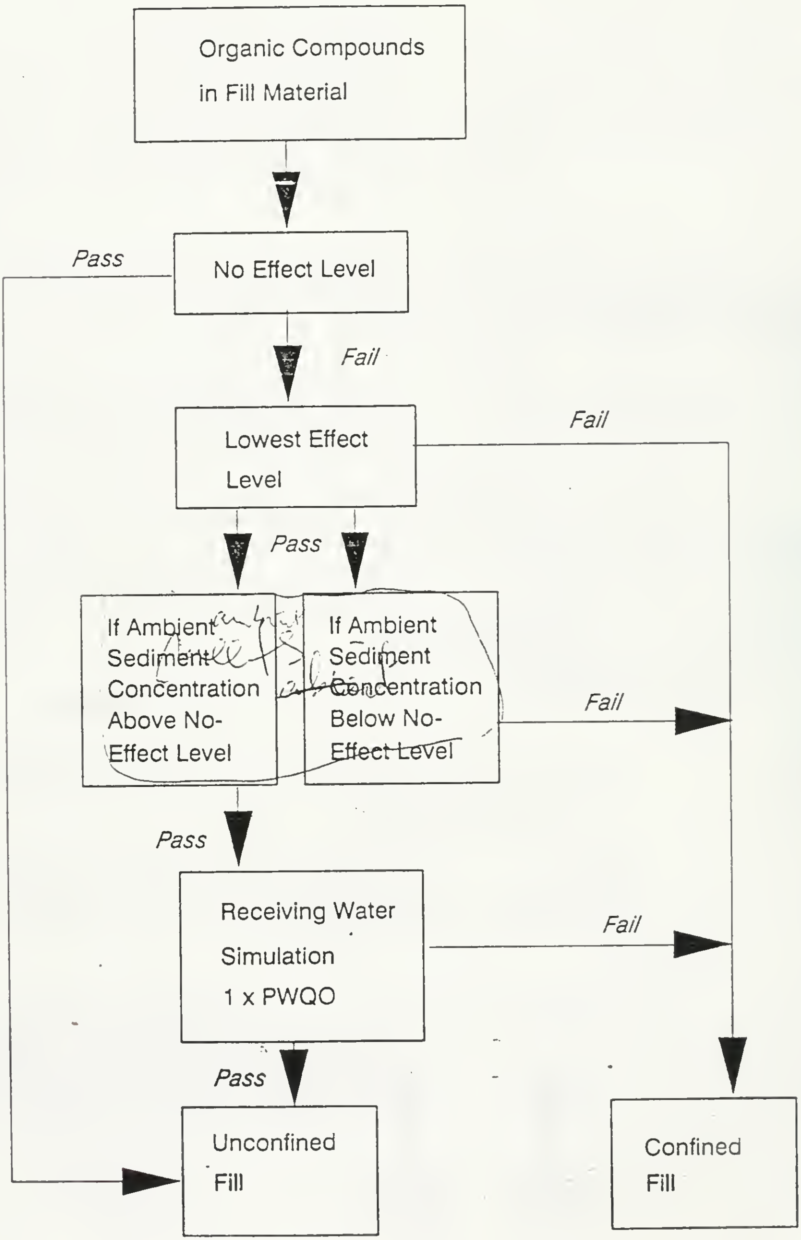
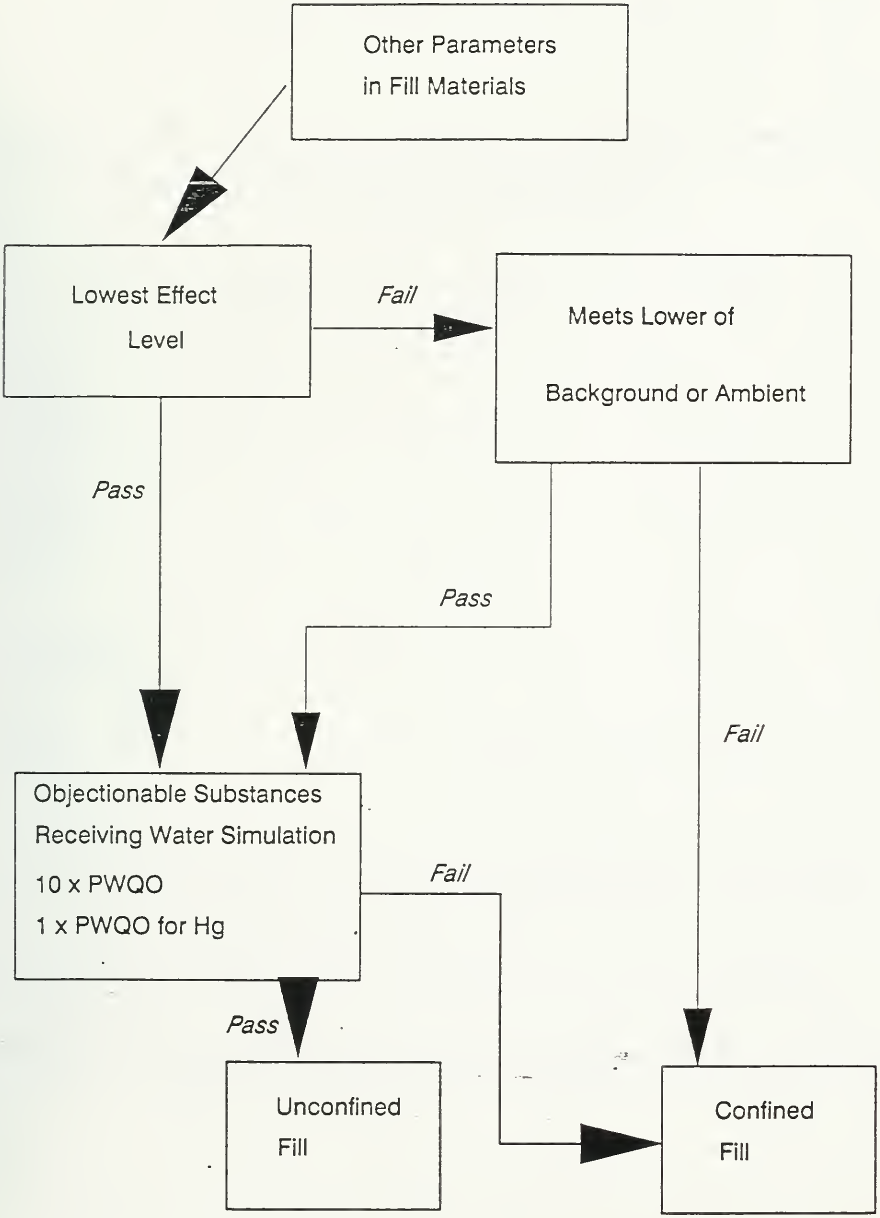

Organic Compounds in Fill Material
No Effect Level
Pass
Fail
Lowest Effect Level
Fail
Pass
If Ambient Sediment Concentration Above No-Effect Level
If Ambient Sediment Concentration Below No-Effect Level
Fail
Pass
Receiving Water Simulation 1 x PWQO
Fail
Pass
Unconfined Fill
Confined Fill

Figure 3. Site Specific Sediment Criteria For Other Parameters



APPENDIX A

PROVINCIAL SEDIMENT QUALITY GUIDELINES

Table 1: Provincial Sediment Quality Guidelines for Metals and Nutrients.
(values[a] in ug/g (ppm) dry weight unless otherwise noted)

METALS	No-Effect Level	Lowest Effect Level	Severe Effect Level
Arsenic	-	6	33
Cadmium	-	0.6	10
Chromium	-	26	110
Copper	-	16	110
Iron (%)	-	2	4
Lead	-	31	250
Manganese	-	460	1100
Mercury	-	0.2	2
Nickel	-	16	75
Zinc	-	120	820
NUTRIENTS			
TOC (%)	-	1	10
TKN	-	550	4800
TP	-	600	2000

[a] - values less than 10 have been rounded to 1 significant digit. Values greater than 10 have been rounded to two significant digits except for round numbers which remain unchanged (e.g., 400).

"-" - denotes insufficient data/no suitable method.

TOC - Total Organic Carbon TKN - Total Kjeldahl Nitrogen TP - Total Phosphorus

(Lakefill February 1992)

Table 2: Provincial Sediment Quality Guidelines for Organic Compounds.
(values[a] in µg/g (ppm) dry weight unless otherwise noted)

Compound	No Effect Level	Lowest Effect Level	Severe Effect Level (µg/g organic carbon)*
Aldrin	-	0.002	8
BHC	-	0.003	12
α-BHC	-	0.006	10
β-BHC	-	0.005	21
γ-BHC	0.0002	(0.003)[b]	(1)[c]
Chlordane	0.005	0.007	6
DDT(total)	-	0.007	12
op+pp-DDT	-	0.008	71
pp-DDD	-	0.008	6
pp-DDE	-	0.005	19
Dieldrin	0.0006	0.002	91
Endrin	0.0005	0.003	130
HCB	0.01	0.02	24
Heptachlor	0.0003	-	-
H epoxide	-	0.005[b]	5[c]
Mirex	-	0.007	130
PCB(total)	0.01	0.07	530
PCB 1254[d]	-	(0.06)[b]	(34)[c]
PCB 1248[d]	-	(0.03)[b]	(150)[c]
PCB 1016[d]	-	(0.007)[b]	(53)[c]
PCB 1260[d]	-	(0.005)[b]	(24)[c]
PAH (total)	-	(2)	(11,000)

Lowest Effect Levels and Severe Effect Levels are based on the 5th and 95th percentiles respectively of the Screening Level Concentration (SLC) (see Section 4.2.4) except where noted otherwise.

( ) Denotes tentative guidelines

[a] - Values less than 10 have been rounded to 1 significant digit. Values greater than 10 have been rounded to 2 significant digits except for round numbers which remain unchanged.

[b] - 10% SLC.

[c] - 90% SLC.

[d] - Analyses for PCB Arochlors are not mandatory unless specifically requested by MOE.

- Insufficient data to calculate guideline.

* Numbers in this column are to be converted to bulk sediment values by multiplying by the actual TOC concentration of the sediments (to a maximum of 10%), e.g. analysis of a sediment sample gave a PCB value of 30 ppm and a TOC of 5%. The value for PCB in the Severe Effects column is first converted to a bulk sediment value for a sediment with 5% TOC by multiplying 530 x 0.05 = 26.5 ppm as the Severe Effect Level guidelines for that sediment. The measured value of 30 ppm is then compared with this bulk sediment value and is found to exceed the guideline.

PAH (total) is the sum of 16 PAH compounds: Acenaphthene, Acenaphthylene, Anthracene, Benzo(k)fluoranthene, Benzo(b)fluorene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i,)perylene, Chrysene, Dibenzo(a,h,)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene and Pyrene.

(Lakefill February 1992)

APPENDIX B

Interim* Confined Fill Guidelines Mandatory Parameter List

Material of Residential/Agricultural Origin

PARAMETER	GUIDELINE ug/g
Antimony	0.43
Arsenic	11
Barium	160
Beryllium	1.1
Cadmium	0.7
Chromium VI	1
Chromium (total)	58
Cobalt	16
Copper	41
Lead	45
Mercury	0.2
Molybdenum	1
Nickel	38
Selenium	0.93
Silver	0.27
Vanadium	77
Zinc	120
Electrical Conductivity	0.36
Sodium Absorption Ratio	0.7
pH	3-10

PLUS: Any elements or compounds which an examination of the history of origins of the material indicate are likely to be of concern.

In addition, material that may be considered for use as Unconfined Fill should also be analysed for PCBs, Total Organic Carbon and Total Phosphorus. These analyses are not required if the material is being considered only as Confined Fill.

* These interim guidelines are adapted from the Proposed Policy for Management of Excess Soil, Rock and Like Materials. MOE May 1992 (draft) and define the upper limit of material that can be used in a lakefill.

Material of Industrial/Commercial Origin

PARAMETER	GUIDELINE (ug/g)
Inorganics	
As listed for Material of Residential/Agricultural Origin	
Volatile Organic Compounds	
Benzene	0.002
Toluene	0.002
Xylene (total)	0.002
Carbon tetrachloride	0.002
Trichloroethylene	0.004
Trichlorofluoromethane	0.012
Methylene chloride (dichloromethane)	0.003
Ethylene dichloride (1,2-dichloroethane)	0.002
1,1,1-trichloroethane	0.005
Tetrachloroethylene	0.002
Polychlorinated Biphenyls	
PCBs	0.3
Polycyclic Aromatic Hydrocarbons	
Benzo(a)pyrene	0.05
Dibenz(a,h)anthracene	0.1
Benzo(a)anthracene	0.05
Benzo(g,h,i)perylene	0.1
Fluoranthene	0.14
Phenanthrene	0.092
Naphthalene	0.05
Pyrene	0.11
Phenols	
2,4,6-trichlorophenol	0.1
2,4-dichlorophenol	0.1
p-cresol	0.1
pentachlorophenol	0.1

Plus

Any elements or compounds, which an examination of the history of origins of the material indicate, are likely to be of concern.

APPENDIX C

APPLICATION CONSIDERATIONS FOR LAKEFILL GUIDELINES

Formal application procedures for lakefilling are to be developed as part of the comprehensive Lakefill Policy. On an interim basis, the strategy outlined below has been developed based on existing procedures.

Types of Projects

The fill quality guidelines apply to all new and on-going lakefill projects (on-going projects may be reviewed on a case-by-case basis and exemptions may be granted by the regional Director if the proponent can demonstrate that no adverse effects are likely to result from such an exemption) including:

- shoreline stabilization projects
- construction of piers, groynes, docks, and causeways
- construction of breakwaters and Confined Disposal Facility (CDF) perimeter walls/structures
- large-scale projects for recreational purposes (e.g., Bluffers Park)
- beach creation
- enclosure dykes or dams for mine tailings ponds.

Lakefill fill quality guidelines do not apply to:

- material placed within a CDF structure such as dredge spoils and mine tailings. These are granted approval under Part V of the E.P. Act and conditions of disposal will be regulated through Certificates of Approval since these structures are designed to contain specific materials for disposal
- material placed on shorelands above the high water mark and adequately stabilized or protected
- filling behind impermeable barriers such as concrete or sheetpile revetment walls (subject to appropriate treatment of decant water).

Projects exempted from the Fill Quality Guidelines

- projects designated as emergency shoreline works (designated by a regional Director), e.g., repairs and maintenance to flood and beach protection works.

Project Specific Application Procedures

Large Scale Projects Subject to the Environmental Assessment (E.A.) Act: All projects subject to the Environmental Assessment (E.A.) Act (either Full E.A. or Class E.A.) would typically proceed through the Environmental Assessment process and the Guidelines would be applied through conditions written into the Terms and Conditions of Approval of the project. In the case of Class E.A.s, this information would be contained in the Environmental Study Report of individual projects. It is expected that when Class E.A.s having lakefilling components come up for review they will specifically address and comply with the Lakefill Policy. It should be noted that Lakefill projects are not waste disposal facilities and as such would not come under Part V of the E.P. Act and would not require a Certificate of Approval.

Fill quality guidelines and other design and construction mitigation measures as may be required as part of fulfilling the E.A. Act would be established as specific conditions and procedures to be used in the E.A. process. This would require the proponent to provide details in the initial E. A. document of how lakefilling would be done and what environmental safeguards would be followed. These would then become part of the conditions of approval of the E.A.

Large-scale Projects not designated under and/or exempted from the E.A. Act.
Proponents of projects exempted from the E.A. Process are not exempted from any of the guidelines or other policies related to lakefilling and are required to provide to the MOE Regional Director all information on fill quality and construction techniques (i.e. engineering design) that would normally have been required for E.A. Approval. In addition the proponent should ensure that the project is not in contravention of any other Federal or Provincial statutes.

Federal Projects (CDFs, Small Craft Harbours): All Federal projects are exempt from Provincial legislation. In the past, the Federal government, through Environment Canada, has been willing to impose Provincial guidelines/policies on federal projects. The province expect this level of cooperation will continue under the new guidelines.

Small-scale Provincial and Private: most small-scale projects would require a Ministry of Natural Resources (MNR) Work Permit. The MNR work permit system is operated under the Public Lands Act and provides that no person shall dredge or fill a shoreland or work on any public land without a work permit. MNR permits give consideration to fisheries concerns (Fisheries Act) and projects that could alter or destroy fish habitat would normally not be granted a work permit.

MOE comments on projects under the MNR permitting system. This is currently done on an informal basis but allows MOE Districts and/or Region to review and comment on all small scale lakefilling projects. The proponent initially applies for approval through the Public Lands Act. The proponent is then instructed to contact the MOE District Office. Currently most of the projects submitted for approval have a perimeter constructed of clean material (granular, rock, sheet piles) prior to backfilling with fine material. For larger projects, the proponent often identifies the source of the backfill material "borrow area".

General Conditions Governing Fill Evaluation

a) Certain types of material are considered acceptable for lakefilling. These include concrete rubble, as well as sand, gravel and excavated soils. Some materials, such as asphalt and construction debris, are not considered acceptable for use in contact with open water, though such material may be considered for use where the proponent is able to demonstrate, through studies funded by the proponent, that the material will not adversely affect the aquatic environment.

b) Classification criteria for fill have been developed in conjunction with Materials Management Policy. A single series of analytical tests are required for material classification. Material will be tested by bulk sediment analysis and results reported on a dry weight basis (see *Sampling and Analytical Protocols* in the Proposed Policy for Management of Excess Soil, Rock and Like Materials for sampling procedures). According to the results of these tests, material classified as Inert Fill (Proposed Policy for Management of Excess Soils, Sediments and Like Materials) can then be placed in a lakefill. No additional testing is required at this stage if the material is destined only for use as Confined Fill.

c) Material that passes additional tests as outlined in this document can qualify as Unconfined Fill and can be placed in contact with open water. In order for material to be classified as Unconfined Fill, it must pass the Provincial Sediment Quality Guidelines criteria, which will not require additional testing to the bulk test referred to above, as well as a Receiving Water Simulation test, which will require additional testing.

The testing requirements, such as minimum number of samples, site history, etc. are detailed in the *Sampling and Analytical Protocols* developed as part of the Proposed Policy for Management of Excess Soil, Rock and Like Materials. As a minimum, analysis will include all parameters identified in Table 1. Additional parameters may be required by MOE regional offices on a case-by-case basis, depending on site history.

General Conditions Governing Fill Placement

- filling should only take place during a defined calm period (i.e., June to August or MNR Hindcast Method) in those areas subject to storm/wave damage.
- exposed fill face should not be more than a specified length, usually 15 metres.
- in instances where Confined Fill will be used in a lakefill, the outer structure must be constructed of material meeting the Unconfined Fill criteria (e.g., quarry stone, concrete rubble, or other similarly inert material (as per Policy for Management of Excess Soils, Sediments and Like Materials). The outer structure must be completed to provide full protection before commencing placement of material classified as Confined Fill.

Siting and Design Considerations

The following general provisions must be given full consideration during the siting and design phase to ensure a lakefill will not affect water uses.

Lakefills:

- should be located so as not to affect water intakes or outfalls.
- should be located so as not to affect navigation routes or shipping channels.
- should be located such that erosion of material will not affect the structural or functional integrity of onshore and offshore discharges or intakes or other sensitive water uses.
- should be designed to minimize the creation of embayment areas, minimize the amount of semi-protected shoreline created, maximize the flushing of embayments reducing the deposition of sediments, so as to avoid direct input of storm sewers or other discharges into embayments created.